American Journal of Engineering Research (AJER)
e-ISSN : 2320-0847 p-ISSN : 2320-0936
Volume-03, Issue-06, pp-340-344
www.ajer.org

Research Paper Open Access

The Next Generation Sustainable Fuel : Jatropha Curcas

Namita Rajput
Govt. Polytechnic College Balaghat (M.P.) India 481001

Abstract: - Any nation's socioeconomic prosperity is heavily dependent of the availability of energy. But with increasing population and pace of industrialization, especially in developing countries like India, the world is today faced with imminent energy crisis. Skyrocketing oil prices combined with growing concern about global warming caused by greenhouse-gas-emitting fossil fuel burning in forcing scientists to look for viable, clean alternative energy sources for the future. Renewable sources like solar, wind and tidal energy are clean, but they are still too expensive and can not provide the convenience of petrol or diesel for powering vehicles.
Biofuels are the new emerging class of renewable, biodegradable fuel that are non-hazardous and safer for air, water and soil. Also their use reduces the emission of greenhouse gases. Biodeisel is the most common biofuel that can be used directly in any existing, unmodified diesel engine. When used directly in a diesel engine biodiesel is said to produce 75% less pollution than diesel fuel derived from petroleum. Biodiesel can be produced from a variety of oilseed plants. But Jatropha (Jatropha curcas) is currently the first choice because it is resistant to drought and pests; produces seeds containing up to 40% oil, and can yield up to two tones of biodiesel fuel per year per hectare.

Keywords: - *Biofuels, jatropha, transesterification.*

I. INTRODUCTION

The concept dates back to 1885 when Dr. Rudolf Diesel built the first diesel engine with the full intention of running it on vegetative source. He first displayed his engine at the Paris show of 1900 and astounded everyone when he ran the patented engine on any hydrocarbon fuel available - which included gasoline and peanut oil. In 1912 he stated " … the use of vegetable oils for engine fuels may seem insignificant today. But such oils may in the course of time become as important as petroleum and the coal tar products of present time."

Scientists discovered that the viscosity (thickness) of vegetable oils could be reduced in a simple chemical process In 1970 and that it could work well as diesel fuel in modern engine. Since than the technical developments have largely been completed. Plant oil is highly valued as Bio fuel "Diesel" and transformed into Bio Diesel in most industrialized

Bio Diesel is a substitute for, or an additive to, diesel fuel that is derived from the oils and fats of plants, like Sunflower, Canola or Jatropha. It is an alternative fuel that can be used in diesel engines and provides power similar to conventional diesel fuel. Bio Diesel is a renewable domestically produced liquid fuel that can help reduce the countries dependence on foreign oil imports. Recent environmental and economic concerns (Kyoto Protocol) have prompted resurgence in the use of biodiesel throughout the world. In 1991, the European Community, (EC) Proposed a 90% tax reduction for the use of biofuels, including biodiesel. Today, 21 countries worldwide, produce Biodiesel.

Jatropha curcus or Ratanjyot, can prove itself a miracle plant by turning waste land into a moneymaking land. It can help to increase rural incomes, self-sustainbility and alleviate poverty for women, elderly, children and men, triabal communities, small farmers. Jatropha curcus is a drought-resistant perennial, growing well in marginal/poor soil. It is easy to establish, grows relatively quickly and lives, producing seeds for 50 years.

Jatropha the wonder plant produces seeds with an oil content of 37%. The oil can be combusted as fuel without being refined. It burns with clear smoke-free flame, tested successfully as fuel for simple diesel engine. The by-products are press cake a good organic fertilizer, oil contains also insecticide. It is found to be growing in many parts of the country, rugged in nature and can survive with minimum inputs and easy to propagate. Medically it is used for diseases like cancer, piles, snakebite, paralysis, dropsy etc. Jatropha grows wild in many areas of India and even thrives on infertile soil. A good crop can be obtained with little effort. Depending on soil quality and rainfall, oil can be extracted from the jatropha nuts after two to five years. The annual nut yield ranges from 0.5 to 12 tons. The kernels consist of oil to about 60 percent; this can be transformed into biodiesel fuel through esterification [1-4].

II. OIL EXTRACTION FROM JATROPHA SEEDS

Below are some of the methods that are usually followed to extracts the oils from jatropha seeds [5-7].

2.1 Oil Presses

Oil presses method is used to extract the oil using simple mechanical devices. It is also done manually. The most commonly used oil presses method is the Bielenberg ram press method. Bielenberg ram press method is a simple traditional method that uses simple devices to extract the oils. With the help of this method 3 liters of oil can be obtained with 12 kg of seeds.

2.2 Oil Expellers

Oil expellers method is also use for jatropha oil extraction. The most commonly used method is the Sayari oil expeller method. This method is also called as Sundhara oil expeller. Komet oil expellers are also used.These sayari oil expellers was developed in Nepal and is a diesel operated one. Now it is developed in Tanzania and Zimbabwe mainly for the production jatropha oil. Heavy oil expellers are made of heavy cast iron and the light ones are made up of iron sheets. Electricity driven models are also available. Komet oil expeller is a single oil expeller machine that is used not only to extract the jatropha oil as well for the preparation of the oil cakes.

2.3 Traditional Methods

Traditional methods are used in the rural and developing areas for extracting the oils. Traditional methods are simple and the oil is extracted by hand using simple equipment.

2.4 Hot oil extraction

The process of extracting the oil at high pressure is called as hot oil extraction method. Since jatropha oil can regulate the operating temperature it is extracted using the hot oil extraction method.Then the cold oil extraction method it is easy to extract the oil from the hot oil extraction since the oil flows more easily due to higher viscosity. And the press cake that remains after extracting the oil also have less oil content which might be 3 to 7 % approximately. These two reasons make the oil press method very interesting.During the oil

extraction method many stuffing of the seeds are converted into gum like substances and some non organic substances. These are unwanted products and so they have to be refined.

2.5 Modern Concepts

Modern methods are followed to extract more oils from the jatropha seeds. In these modern concepts chemical methods like aqueous enzymatic treatment is used. The maximum yield by following this modern method is said to be about 74/5.The main idea in researching the modern concepts is to extract a greater percentage of oil from the jatropha seeds.

III. TRANSESTERIFICATION BIODIESEL PROCESS

The process of converting vegetable oil into biodiesel fuel is called Transesterification and is luckily less complex then it sounds. Chemically, Transesterification means taking a triglyceride molecule, or a complex fatty acid, neutralizing the free fatty acids, removing the glycerin, and creating an alcohol ester. This is accomplished by mixing methanol with sodium hydroxide to make sodium methoxide. This liquid is then mixed into the vegetable oil. After the mixture has settled, Glycerin is left on the bottom and methyl esters, or biodiesel is left on top and is washed and filtered. The final product Bio Diesel fuel, when used directly in a Diesel Engine will burn up to 75% cleaner then mineral oil Diesel fuel [5-6].

Raw materials required

- Jatropha oil
- Methanol
- Potassium hydroxide
- Isopropyl alcohol
- Distilled water
- Phenolphthalein solution
- Vinegar
- Water

Here is a chart that describes the process of oil extraction from the seeds, Jatropha oil extraction chart

IV. BIODIESEL SCENARIO IN INDIA

The technology is mature and proven. Presently, the indigenously designed bio-fuel plant for 250 lt./day is in operation. We have to design and develop bio-fuel plants of 3 to 10 tones per day capacity for installation in different parts of the country. Effective marketing chain needs to be planned for enabling farmers to reap the benefits directly. Bio-fuel mission will provide technological and employment generation focuses for

the rural sector. Use of eleven million hectares of wasteland for Jetropha cultivation can lead to generation of minimum twelve million jobs

As India is deficient in edible oils, non-edible oil is the main choice for producing biodiesel. According to Indian government policy and Indian technology effects. Some development works have been carried out with regards to the production of transesterfied non edible oil and its use in biodiesel by units such as Indian Institute of Science, Bangalore, Tamilnadu Agriculture University Coimbatore and Kumaraguru College of Technology in association with Pan horti consultants. Coimbatore. Generally a Blend of 5% to 20% is used in India (B5 to B20). Indian Oil Corporation has taken up Research and development work to establish the parameters of the production of tranesterified Jatropha Vegetable oil and use of bio diesel in its R&D center at Faridabad. Research is carried out in Kumaraguru College of Technology for marginally altering the engine parameters to suit the Indian Jatropha seeds and to minimize the cost of transesterification[8-9].

V. THE COST

The cost of Bio Diesel is largely dependent on the choice of feedstock and the size of the production facility.If Jatropha feedstock is used, the fuel will cost depending on the country approximately US $ 0,40 per liter plus tax when applicable.

FEED STOCK PRODUCTION PER HECTARE & COST THEREOF

FEEDSTOCK	Country	Yield/hectare (kg)	Rate per barrel(US$)
SOYA OIL	USA	375	73
RAPESEED OIL	Europe	1000	78
JATROPHA OIL	INDIA	3000	43
PALM OIL	Malaysia	5000	46

VI. ADVANTAGES OF JATROPHA CURCUS

- It starts producing seeds within 12 months
- Maximum productivity level is 4-5 years
- Plant remains useful for around 35-50 years
- Seeds can produce around 37% oil content
- Kernels can produce up to 60% oil content
- Its seeds yield an annual equivalent of 0.75 to 2 tons of biodiesel per hectare
- It is a NON-FOOD CROP.

VII. THE ADVANTAGES OF BIO DIESEL

Bio Diesel is the most valuable form of renewable energy that can be used directly in any existing, unmodified diesel engine [6,10-12]

- **Energy Independence:** Considering that oil priced at $60 per barrel has had a disproportionate impact on the poorest countries, 38 of which are net importers and 25 of Which import all of their oil; the question of trying to achieve greater energy independence one day through the development of biofuels has become one of ‘when’ rather than ‘if,’ and, now on a near daily basis, a biofuels programme is being launched somewhere in the developing world.
- **Smaller Trade Deficit:** Rather than importing other countries’ ancient natural resources, we could be using our own living resources to power our development and enhance our economies. Instead of looking to the Mideast for oil, the world could look to the tropics for biofuels. producing more biofuels will save foreign exchange and reduce energy expenditures and allow developing countries to put more of their resources into health, education and other services for their neediest citizens.
- **Economic Growth:** Biofuels create new markets for agricultural products and stimulate rural development because biofuels are generated from crops; they hold enormous potential for farmers. At the community level, farmers that produce dedicated energy crops can grow their incomes and grow their own supply of affordable and reliable energy.At the national level, producing more biofuels will generate new industries, new technologies, new jobs and new markets.
- **Cleaner Air:** Biofuels burn more cleanly than gasoline and diesel. Using biofuels means producing fewer emissions of carbon monoxide, particulates, and toxic chemicals that cause smog, aggravate respiratory and heart disease, and contribute to thousands of premature deaths each year.
- **Less Global Warming:** Biofuels contain carbon that was taken out of the atmosphere by plants and

trees as they grew. The Fossil fuels are adding huge amounts of stored carbon dioxide (CO2) to the atmosphere, where it traps the Earth's heat like a heavy blanket and causes the world to warm. Studies show that biodiesel reduces CO2 emissions to a considerable extent and in some cases all most nearly to zero.

- **Soap production:** The glycerin that is a by-product of biodiesel can be used to make soap, and soap can be produced from Jatropha oil itself. It will produce a soft, durable soap, and the rather simple soap making process is well adapted to household or small-scale industrial activity.
- **Other Uses:** Jatropha oil is also used to soften leather and lubricate machinery
- It is excellent at preventing soil erosion, and the leaves that it drops act as soil-enriching mulch

VII. CONCLUSION

As a substitute for fast depleting fossil fuel. Bio diesel had come to stay. In future, it should also serve to reduce and maintain the price of automobile fuel. The under exploited and un exploited vegetable oils are good sources of biofuel. Our country is endowed with many such plants. Research is being carried out now to convert vegetable oils into biodiesel through biotechnological processes using biodiesel. With a concentrated and coordinated effort. Wide use of bio diesel in our country is going to be a reality in the days to come. A national mission on Bio-Diesel has already been proposed by the committee comprising six micro missions covering all aspects of plantation, procurement of seed, extraction of oil, trans-esterification, blending & trade, and research and development. Diesel forms nearly 40% of the energy consumed in the form of hydrocarbon fuels, and its demand is estimated at 40 million tons.

Therefore blending becomes the important National Issue which apart from giving the dividends , it saves the country's exchequer. India has vast stretches of degraded land, mostly in areas with adverse agro-climatic conditions, where species of Jatropha , Mahua etc can be grown easily. Even 30 million hectares planted for bio- diesel can completely replace the current use of biofuels. The production of Bio fuels will also boost the rural economy which will bring more enthusiasm in more than one billion lives in the area.

REFERENCES

[1]. Biodeisel basics “National Biodiesel Board” retrieved 30-01-2009.
[2]. When oil grows on trees, World Agroforestry Centre , 2007.
[3]. J. Serra “Alternative fuel resource development” Clean and green fuel fund , 2006.
[4]. Phil McKenna, All Washed Up for Jatropha? The draught-resistant "dream" biofuel is also a water hog. Technology Review, Tuesday, June 9, 2009.
[5]. S. Antony Raja, D.S. Robinson Smart, C. Lindon Robert Lee, Biodiesel production from jatropha oil and its characterization, Res. J. Chem. Sci. 1(1), 2011, 81-87.
[6]. W.M.J. Achten , L. Verchot , Y.J. Franken , E. Mathijs, V.P. Singh, R. Aerts, B. Muys, Jatropha bio-diesel production and use. (a literature review), Biomass and Bioenergy, 32(12), 2008, 1063-1084.
[7]. L. Singh, S.S. Baragali and S.L. Swamy, Production practices and post-harvest management - Focus of Jatrohpha, Proc. of the biodiesel conf. toward energy independance , Hyderabad, India, 2006, 252-267.
[8]. R.S. Kureel, Biofuel Senario in India, REDA News, 4, 2007, 5-12.
[9]. Michael Fitzgerald (December 27, 2006). "India's Big Plans for Biodiesel". Technology Review (Massachusetts Institute of Technology). http://www.technologyreview.com/Energy/17940/. Retrieved 03-05-2007.
[10]. O.O. Igbinosa, E.O. Igbinosa and O.A. Aiyegoro Antimicrobial activity and phytochemical screening of stem bark extracts from Jatropha curcas (Linn), African Journal of Pharmacy and Pharmacology Vol. 3(2), 2009, 058-062 .
[11]. Poison plant could help to cure the planet Times Online, 28 July 2007.
[12]. K.M. Rahman, Md. Mahsud, Md. Roknuzzman, A. Al. Galib, Biodiesel from jatropha oil as an alternative fuel for diesel engine, IJMME-IJENS, 10(3), 2010, 1-6.